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Functional assessment and function-based treatment delivered via telehealth: A brief summary

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As the world navigates the COVID-19 health crisis, behavior analysts are considering how best to support families while maintaining services and ensuring the health and safety of everyone involved. Telehealth is one service delivery option that provides families with access to care in their own communities and homes. In this article, we provide a brief summary of the telehealth literature in applied behavior analysis that provided coaching and training to families for individuals who displayed challenging behavior. These studies targeted functional assessment and function-based treatment for challenging behavior. We briefly summarize what is known relative to the assessment and treatment of challenging behavior via telehealth, place these results within a descriptive context of the decisions made by the research team at the University of Iowa, and discuss what we, as behavior analysts, should consider next to advance our understanding and practice of telehealth.

Key words: challenging behavior, functional assessment, function-based treatment, telehealth

With the rise in positive COVID-19 cases and the uncertainty of the immediate future, most people are scrambling to figure out how to best respond to unusual circumstances. Parents are determining what to do with their children who are home from school, administrators are determining how and where their employees will work, and citizens are determining when it is "essential" to be out of their homes. It is within this context that behavior analysts must consider how to best use telehealth as one way to continue providing services because it can offer clients and their families support while maintaining the health and safety of everyone involved.

Telehealth may be a somewhat unfamiliar concept for some of us. Others, including our research and clinical teams at The University of Iowa, have at least some experience with telehealth; however, those services now need to expand. For all of us, understanding, developing, and/or expanding a telehealth service during this public health crisis may be a daunting task, which may be further compounded by the vast amount of information, some of which is inaccurate, coming to us from social media, professional organizations, and policy makers. Regardless, a large expansion of telehealth services is undoubtably about to occur.

For example, the Office of Civil Rights at the U.S. Department of Health and Human Services (2020) posted a notification loosening the regulatory requirements under HIPAA rules for telehealth service delivery. This notification essentially communicates that healthcare providers will not be penalized if they use a HIPAA-noncompliant communication modality (nonpublic facing such as Google Hangout

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or Apple FaceTime) to engage in service delivery via telehealth during this pandemic. Additionally, the Behavior Analyst Certification Board (2020) and the Council for Autism Service Providers (2020) provided ethical guidelines for behavior analytic providers during this health crisis. Some of those guidelines suggested the use of telehealth to augment suspended in-person services, but advised providers to fully consider the potential risks to the clients (e.g., risk of injury if services are suspended versus if services are provided via telehealth).

Telehealth, which is the most common label, has been used as a service delivery model for over 50 years (American Telemedicine Association, 2020); however, from 2005-2014, the annual compound growth rate of its use has averaged 52% (Barnett et al., 2018) and 86% of publications focused on telehealth have occurred within the past 10-15 years (Wacker et al., 2016). Telehealth actually describes a variety of service-delivery methods that use communication technologies for the purposes of enhancing health care, public health, and health education (Center for Connected Health Policy, 2020), as well as extending capacity and access to health care (American Telemedicine Association, 2020). Services provided via telehealth encompass a wide range of health care activities including diagnosis, management, and education, with telehealth activities ranging from synchronous to asynchronous interactions that include live videoconferencing between a provider and patient (e.g., consultation), store-and-forward transmission of patient data for later review (e.g., diagnostic images), and remote patient monitoring of data for interpretation (e.g., blood glucose levels) (American Telemedicine Association, 2020; Center for Connected Health Policy, 2020).

Specific to behavior analysis, synchronous interactions or live videoconferencing has been the most common form of telehealth for the purposes of consultation between providers and the direct assessment and treatment of challenging behavior displayed by children (Tomlinson et al., 2018; Wacker et al., in press). As demonstrated in recent systematic reviews, the behavior analytic database utilizing telehealth as a service delivery model has largely shown positive effects (Ferguson et al., 2019; Neely et al., 2017; Tomlinson et al., 2018; Unholz-Bowden et al., 2020). For example, Lindgren et al. (2016) showed that clinical outcomes obtained via telehealth and parental acceptability were comparable to in-person modes of service delivery, whereas the cost-effectiveness improved when practitioners delivered these services via telehealth rather than in person.

Previous systematic reviews have focused on the acceptability of telehealth (Tomlinson et al., 2018), the effects of training providers and caregivers via telehealth on implementation fidelity (Neely et al., 2017; Unholz-Bowden et al., 2020), and the methodological quality of studies conducted via telehealth (Ferguson et al., 2019; Tomlinson et al., 2018). In this article, we summarize the behavior analytic literature relative to clients who received functional assessment and/or function-based treatment via telehealth for the purpose of decreasing the occurrence of challenging behavior. Specifically, we (a) provide a brief summary of the characteristics of the clients and the outcomes of telehealth evaluations, published to date, on challenging behavior, (b) place this summary within a descriptive context of the decisions our research team at the University of Iowa made when determining how to provide behavior analytic assessment and treatment procedures via telehealth, and (c) discuss the clinical and research implications of these results. This article is not meant to be a comprehensive review of the literature. Rather, it is meant to serve as a discussion of what has been done, to date, relative to the functional assessment and treatment of challenging behavior via telehealth, what gaps exist in our knowledge, and what telehealth offers for future clinical

practice and research as our field shifts to providing at least some portion of our services via telehealth.

Brief Historical Overview

For our brief summary, we reviewed the existing literature that reported the results of functional assessments and/or function-based treatments via telehealth to address the occurrence of challenging behavior. Our summary is restricted to behavior analytic studies that conducted and reported the results of functional assessment and/or function-based treatment procedures on the challenging behavior displayed by individuals with developmental disabilities when those procedures were conducted with remote training and/or coaching. In Table 1, we provide a summary, in chronological order, of the characteristics and outcomes of each individual study. In Table 2, we provide an aggregate summary of these characteristics and outcomes. We excluded studies that did not report the outcomes for the individuals with challenging behavior (e.g., studies that only reported the outcomes of behavioral skills training on the implementer's behavior; Alnemary et al., 2015; Machalicek et al., 2010; Rios et al., 2020).

Across the 18 studies reviewed in Table 1 and summarized in Table 2, participants were mostly male (N = 104; 81% of participants) with a diagnosis of autism spectrum disorder (N = 97; 76% of participants) and between the ages of 2 to 6 years old (N = 65; 72% of participants). The challenging behaviors of concern for each participant were relatively equal across the behavioral topographies of self-injury, aggression, tantrums, and destruction (range, 16% - 23%) with the majority of participants engaging in multiple topographies. The remote site setting (place at which the client and family were located) where assessment and treatment procedures were conducted occurred mostly in the home (N = 76; 59% of participants) and the clinic (N = 46; 36% of participants). The individuals who implemented the procedures with the participants were most often parents (N = 122; 95% of participants) who were coached remotely by a behavior consultant (N = 125; 98% of participants) located within the state boundaries of the participant (N = 109; 85%). All procedures were conducted synchronously or in real time.

Functional Assessment

Wacker and colleagues (Barretto et al., 2006) began using telehealth as a service delivery modality to address the challenging behavior needs of children over 20 years ago. At that time, "telehealth" consisted of fiber optic connections between hospitals, schools, and other service agencies, usually to large conference rooms, across the state of Iowa. Using this connection, Barretto et al. conducted two functional analyses (FAs; Iwata et al., 1982/1994) successfully with young children with developmental disabilities who engaged in challenging behavior. These results provided the first known demonstration of successfully conducting functional assessments for challenging behavior via telehealth.

Following this initial demonstration, additional case examples from both Iowa (Wacker et al., 2013b) and other research groups (Frieder et al., 2009; Machalicek et al., 2009) showed that practitioners can successfully conduct FAs of challenging behavior via telehealth. Positive results continued to be demonstrated across remote site connections, including both clinic-to-clinic (Suess et al., 2016) and clinic-to-home (Benson et al., 2018; Dimian et al., 2018; Hoffman et al., 2019; Lindgren et al., 2020; Machalicek et al., 2016; Martens et al., 2019; Schieltz et al., 2018; Simacek et al., 2017; Suess et al., 2014; Tsami et al., 2019) models. Additionally, although most studies were conducted via telehealth within the state that the behavior consultant

Table 1

Chronological Summary of Telehealth Studies Targeting Challenging Behavior

Study	Participants	Remote Site	Procedures	Results
Barretto et al. (2006)	1 boy, 1 girl *Age range:* 1-5 years *Dx:* ASD or severe ID *Bx:* screaming, noncompliance, destruction, self-injury	*Site:* U.S. Local School or U.S. Local DHS office *Implementer:* Classroom teacher or foster mother and physical therapist *Coach:* School psychologist at remote site with guidance from behavior consultant at the host site or behavior consultant	FA	*FA:* Esc (N = 2)
Frieder et al. (2009)	4-year-old boy *Dx:* developmental delay *Bx:* crying, screaming, aggression	*Site:* U.S. School *Implementers:* Teacher, SLP *Coach:* Behavior consultant in person and via telehealth	FA	*FA:* Tan
Machalicek et al. (2009)	2 girls *Age range:* 7-11 years *Dx:* moderate ID *Bx:* aggression, destruction, self-injury, tantrums	*Site:* U.S. School *Implementer:* Graduate student *Coach:* Supervisor in separate room of the school building	FA	*FA:* Att + Esc (N = 2)
Gibson et al. (2010)	4-year-old boy *Dx:* ASD *Bx:* elopement	*Site:* U.S. School *Implementer:* Teacher, teacher assistant *Coach:* Behavior consultant	FCT	*FCT:* Decreased occurrence of elopement
Wacker et al. (2013a)	17 boys and girls *Age range:* 2-6 years *Dx:* ASD *Bx:* aggression, self-injury, destruction, screaming, elopement	*Site:* U.S. Local Clinics *Implementers:* Mothers or fathers with assistants at the remote site *Coach:* Behavior consultant	FCT for Esc (N = 13); Tan (N = 5); Att (N = 1)	*FCT:* Avg 93% reduction in challenging behavior from baseline levels
Wacker et al. (2013b)	20 boys and girls *Age range:* 2-6 years *Dx:* ASD *Bx:* aggression, destruction, self-injury, disruption, dangerous behavior, repetitive behavior	*Site:* U.S. Local Clinics *Implementers:* Mothers or fathers with assistants at the remote site *Coach:* Behavior consultant	FA	*FA:* Esc (N = 2); Tan (N = 3); Esc + Tan (N = 13); No identified function because of lack of challenging behavior (N = 2)
Suess et al. (2014)	3 boys *Age range:* 2-3 years *Dx:* ASD *Bx:* self-injury, aggression, destruction	*Site:* U.S. Homes *Implementers:* Parents *Coach:* Behavior consultant	FA + FCT	*FA:* Esc + Tan (N = 3) *FCT:* High levels of parent fidelity across coached and independent trials
Suess et al. (2016)	5 boys and girls *Age range:* 2-7 years *Dx:* ASD *Bx:* aggression, self-injury, destruction, crying	*Site:* U.S. Local Clinics *Implementers:* Parents with assistant at the remote site *Coach:* Behavior consultant	FA + FCT	*FA:* Esc (N = 3); Esc + Tan (N = 1); No identified function because of lack of challenging behavior (N = 1) *FCT:* Avg 65% reduction in challenging behavior; Avg

Table 1
Continued

Study	Participants	Remote Site	Procedures	Results
				34% increase in task completion; Avg 87% increase in manding
Machalicek et al. (2016)	3 boys and girls *Age range:* 8-16 years *Dx:* ASD *Bx:* aggression, self-injury, destruction, inappropriate vocalizations, spitting	*Site:* U.S. Homes *Implementers:* Mothers or fathers *Coach:* Behavior consultant	FA + function-based treatment	*FA:* Esc (N = 1); Tan (N = 1); Esc + Tan (N = 1) *Function-based treatment:* Decreased occurrences in challenging behavior
Simacek et al. (2017)	2 girls *Age range:* 3-4 years *Dx:* ASD *Bx:* tantrums	*Site:* U.S. Homes *Implementers:* Mothers or fathers *Coach:* Behavior consultant	FA + FCT	*FA:* Esc (N = 1); Esc + Tan (N = 1) *FCT:* Decreased occurrences of challenging behavior and increased occurrences of mands
Benson et al. (2018)	2 boys *Age range:* 5-8 years *Dx:* ASD or cerebral palsy *Bx:* self-injury	*Site:* U.S. Home *Implementers:* Parents *Coach:* Behavior consultant	FA + FCT	*FA:* Att (N = 1); Tan (N = 1) *FCT:* Decreased occurrences of challenging behavior and increased occurrences of mands
Dimian et al. (2018)	7-year-old boy *Dx:* ASD, Lissencephaly, epilepsy *Bx:* tantrums	*Site:* U.S. Home *Implementer:* Parents *Coach:* Behavior consultant	FA + FCT	*FA:* Esc *FCT:* 100% reduction in tantrums and 30% increase in appropriate manding
Schieltz et al. (2018)	1 boy, 1 girl *Age range:* 2-6 years *Dx:* ASD *Bx:* self-injury, aggression, destruction	*Site:* U.S. Home *Implementer:* Mother *Coach:* Behavior consultant	FA + FCT	*FA:* Tan (N = 1); Tan + Esc (N = 1) *FCT:* Treatment failure *Reason:* Behavior function switched from a social function to an automatic function (N = 1); Poor parent fidelity (N = 1)
Hoffman et al. (2019)	4 boys *Age range:* 1-3 years *Dx:* speech delay, developmental delay, or ASD *Bx:* aggression, self-injury	*Site:* U.S. Homes or U.S. Local ECSE clinic *Implementer:* Parents *Coach:* Behavior specialist at remote site with support from behavior consultant at host site	FA + FCT	*FA:* Att + Tan (N = 1); Att + Tan + Esc (N = 1); Att (N = 1); Tan (N = 1) *FCT:* Decreased occurrences of challenging behavior and increased occurrences of mands
Martens et al. (2019)	3 boys* *Age range:* 4-8 years *Dx:* ASD or Rett syndrome *Bx:* self-injury, aggression, destruction, tantrums	*Site:* U.S. Homes *Implementer:* Parents *Coach:* Behavior consultant	FA	*FA:* Tan (N = 1); Tan + Esc (N = 2)
Monlux et al. (2019)	10 boys *Age range:* 3-10 years *Dx:* Fragile X syndrome *Bx:* self-injury, aggression	*Site:* U.S. Homes *Implementer:* Mothers *Coach:* Behavior consultant	FCT	*FCT:* Avg 88% reduction in challenging behavior from baseline levels
Tsami et al. (2019)	12 boys and girls *Age range:* 3-13 years *Dx:* ASD *Bx:* screaming, aggression, self-injury, destruction, flopping	*Site:* International Homes *Implementers:* Mothers or fathers *Coach:* Behavior consultant and interpreter	FA + FCT	*FA:* Esc (N = 4); Tan (N = 2); Att (N = 2); Esc + Tan (N = 2); Att + Esc (N = 1); Att + Tan + Esc (N = 1) *FCT:* At least 80% reduction in challenging behavior from baseline levels and manding

Table 1
Continued

Study	Participants	Remote Site	Procedures	Results
				occurred during at least 90% of opportunities
Lindgren et al. (2020)	38 boys and girls *Age range:* 1-7 years *Dx:* ASD and/or ID *Bx:* aggression, destruction, self-injury, tantrums	*Site:* U.S. Homes *Implementer:* Parents *Coach:* Behavior consultant	FA + FCT	*FA:* Esc (N = 22); Tan (N = 35); Att (N = 3)** *FCT:* Avg 97% reduction in challenging behavior from baseline levels

Note. Coach was always the behavioral consultant at the host site unless otherwise noted. ASD = autism spectrum disorder; Att = attention function; Avg = average; Bx = target challenging behavior; Dx = diagnosis; ECSE = early childhood special education; Esc = escape function; FA = functional analysis; FCT = functional communication training; ID = intellectual disability; N = number of cases; SLP = speech-language pathologist; Tan = tangible function; U.S. = United States; * = Martens et al. (2019) included a fourth participant whose data were previously reported in Dimian et al. (2018); ** = Lindgren et al. (2020) did not report identified function(s) by participant, but did indicate that most participants had more than one function resulting in a greater sum than total number of participants

practiced, researchers for one study successfully conducted FAs internationally, meaning that the behavior consultant was in the United States, while the child and family were in various countries across the world (Tsami et al., 2019).

FAs were conducted in all studies that reported the results of functional assessments. In the majority of studies, social functions were identified for each participant with escape plus tangible (N = 24; 39% of participants), escape (N = 14; 23% of participants), and tangible (N = 11; 18% of participants) being the most common functions. For the remaining participants, social functions identified were attention (N = 4; 6% of participants), escape plus attention (N = 3; 5% of participants), tangible plus attention (N = 1; 2% of participants), and all social functions (N = 2; 3% of participants). When a function was not identified (N = 3; 5%), it was because challenging behavior did not occur during the assessment. Only one study (Barretto et al., 2006) conducted an alone test condition with one participant, resulting in challenging behavior decreasing to zero across sessions. Thus, it is unknown what percentage of challenging behaviors were maintained by automatic reinforcement. Of the 15 studies that reported the results of FAs, four (27%) conducted analyses of procedural fidelity. Results of these analyses showed that implementation fidelity ranged from 84% to 100% when a behavior consultant coached the implementer remotely.

Function-Based Treatment

Gibson et al. (2010) provided the first successful demonstration of functional communication training (FCT; Carr & Durand, 1985) via telehealth with elopement as the target behavior for one child. Wacker et al. (2013a) followed this demonstration with a summary of a larger set of cases (N = 17) who received FCT via a clinic-to-clinic telehealth model. Results of this study showed that for all children, challenging behavior was reduced by an average of 93% from baseline levels. Improvements in challenging behavior were shown for 98% of participants (range, 65% to 100% reduction in problem behavior), regardless of whether the remote site was a clinic or home, or in the United States or other country (see Schieltz et al., 2018, for two case exceptions). Of the 13 studies that conducted function-based treatments via telehealth, 46% (N = 6)

described the use of treatment fading plans and none described programs for or analyses of generalization (see Falcomata & Wacker, 2013, for a review of generalization procedures conducted with FCT in-vivo). The majority of studies (N = 10; 77%) reported the results of implementation fidelity, which ranged from 74% to 100% of steps completed correctly during coached sessions. For example, Suess et al. (2014) demonstrated relatively high levels of treatment fidelity during coached (range, 77% to 94%) and independent (range, 73% to 80%) treatment trials when implemented by the parents. Although these results are positive, Schieltz et al. (2018) reported one exception, in which the parent achieved only 45% implementation fidelity, resulting in a rare treatment failure.

Treatment acceptability was reported in 54% of the studies from the caregiver perspective, but none reported perceptions of acceptability from the behavior consultant. The results, based primarily on the Treatment Acceptability Rating Form-Revised (TARF-R; Reimers et al., 1991), showed that treatment was highly acceptable to parents (range, 6 – 7 on a 7-point Likert scale).

Decisions Relative to Conducting FAs and FCT via Telehealth at the University of Iowa

More than 50% of the participants in the studies summarized above were enrolled in various research projects at the University of Iowa, most of which were federally funded (Lindgren & Wacker, 2009, 2011, 2015). In this section, we describe why we emphasized telehealth and what guided the methodologies employed within our studies.

Although conducting FAs and FCT via telehealth over 10 years ago may seem bold, this step was a logical extension in the progression of our clinical work. As Wacker (2019) discussed, telehealth is effective only to the extent that the services delivered are valid. Thus, the first step in considering how to use telehealth was to carefully consider what assessment and treatment procedures would be delivered via telehealth. In working with challenging behavior in our clinics, and then in the homes of young children with disabilities (Wacker et al., 2011), we consistently used a two-step model. Step 1 was to conduct an FA, as it has reliably been shown to be the most valid assessment procedure for identifying the variables maintaining challenging behavior (Beavers et al., 2013). Step 2 was to conduct FCT as it is the most commonly used treatment strategy for challenging behavior in applied behavior analysis (Tiger et al., 2008). These assessment and treatment procedures have been widely used, and clinicians and researchers have successfully modified these procedures to accommodate clinical constraints (e.g., Northup et al., 1991). When conducting this two-step model, both in our clinical practices and research projects, we often coached the parents to implement the procedures. Our therapists rarely conducted these procedures with the children when in the homes of children. Rather, our therapists typically coached parents on the procedures from behind video cameras that were used to record the sessions, and only assisted parents with the procedures as needed. Similarly, in clinic, therapists often coached parents on how to conduct the procedures, and then watched them implement those procedures from behind one-way mirrors. Thus, conducting these procedures via telehealth was a logical extension to the work we had been doing for the previous 20 years.

We chose to first conduct these procedures via telehealth in local clinics (Wacker et al., 2013a, b) because we were concerned about maintaining the safety of the child, family, and environment given that we would no longer be present (e.g., behind a video camera) to provide assistance, as necessary. Overall, we were also concerned about whether treatment

Table 2

Summary of Demographics and Outcomes of Telehealth Studies Targeting Challenging Behavior

Study Characteristics	N (%) of Participants
Child Demographics	
Gender (N = 128)	
Male	104 (81%)
Female	24 (19%)
Age (N = 90)*	
0-2 years	3 (3%)
2-6 years	65 (72%)
7-11 years	20 (22%)
12-17 years	2 (2%)
18+ years	0 (0%)
Diagnosis (N = 128)	
ASD	97 (76%)
Developmental Delay	2 (2%)
Speech Delay	2 (2%)
Intellectual Disability	26 (20%)
Fragile X	11 (9%)
Rett Syndrome	1 (1%)
Other	3 (2%)
Not Reported	12 (9%)
Challenging Behavior (N = 128)	
Aggression	28 (22%)
Destruction	21 (16%)
Self-injury	29 (23%)
Tantrums	25 (20%)
Elopement	1 (1%)
Not Reported by Participant	75 (59%)
Assessment and Treatment Methods	
Remote Site Setting (N = 128)	
Home	76 (59%)
Clinic	46 (36%)
School	5 (4%)
Other	1 (1%)
Implementer at Remote Site (N = 128)	
Parent	122 (95%)
Teacher	3 (2%)
Other	3 (2%)
Coach (N = 128)	
Behavior Consultant	125 (98%)
Other	3 (2%)
Coach Setting (N = 128)	5 (4%)
On site with telehealth guidance	2 (2%)
Different Room at Remote Site	109 (85%)
Within the State of the Remote Site	12 (9%)
Different Country of the Remote Site	
Assessment and Treatment Outcomes	
Identified Function(s) (N = 62)*	
Escape + Tangible	24 (39%)
Escape	14 (23%)
Tangible	11 (18%)
Attention	4 (6%)
Escape + Attention	3 (5%)
None Identified	3 (5%)
Escape + Tangible + Attention	2 (3%)
Tangible + Attention	1 (2%)
Automatic	0 (0%)
Treatment Effectiveness (N = 100)**	
Improvements in challenging behavior	98 (98%)

Table 2
Continued

Study Characteristics	N (%) of Participants
No improvements in challenging behavior	2 (2%)
Assessment and Treatment Methods	**N (%) of Studies**
Test Conditions Conducted (N = 15)	
Social (attention, tangible, escape)	15 (100%)
Automatic (ignore, alone)	1 (7%)
Treatment Plan (N = 13)	
Fading	6 (46%)
Generalization	0 (0%)
Treatment Acceptability Measured (N = 13)	
TARF-R	7 (54%)
BIRS-R	1 (8%)
Implementation Fidelity Measured	
Functional Assessment (N = 15)	4 (27%)
Function-based Treatment (N = 13)	10 (77%)

Note. *Age of participants calculations did not include participants from Lindgren et al. (2020) because those data were not reported according to the categories of the present article. **Identified function calculations did not include participants from Gibson et al. (2010), Wacker et al. (2013a), Monlux et al. (2019), or Lindgren et al. (2020) because data were either not reported or not reported according to the categories of the present article. ***Treatment effectiveness calculations only included those studies in which treatment data were reported.

effects would degrade when all procedures were conducted via telehealth. In our first telehealth project (Lindgren & Wacker, 2009), we partnered with child health specialty clinics throughout the state of Iowa. These regional clinics were designed to meet the needs of children with health and behavioral problems, and they had participated in other telehealth projects with pediatric faculty. Thus, they already had the equipment and personnel infrastructure to implement this service modality. Relative to the personnel at these clinics, we hired parents, known as family navigators, to be present during all sessions to set up the clinic rooms and to help maintain the safety of everyone within the environment. They did not conduct any of the sessions and received no special training from us. Our project achieved outcomes (i.e., at least 90% reduction in challenging behavior) comparable to our in-vivo in-home project (Lindgren et al., 2016), leading us to more confidently return to the homes of parents by conducting clinic-to-home telehealth projects (Lindgren & Wacker, 2011, 2015).

We have always chosen to conduct our services synchronously (i.e., in real time), and those services have consisted of a combination of coaching and training. Relative to the FA, we have always coached caregivers to implement the procedures rather than train them to conduct the procedures independently. The FA is an assessment procedure that guides the treatments we select; it is not a procedure families need to conduct in our absence. Thus, whether in-person or via telehealth, our therapists are present and provide coaching prior to, during, and following each session. Coaching consists of an explanation of the procedures prior to a session that includes the what, why, and how the procedures will be conducted. During sessions, coaching consists of specific directives on which procedure to implement (e.g., presentation or removal of the motivating operation), when to implement it, and for how long. We ask parents to closely follow our directions and we correct all fidelity issues immediately. Additionally, we often provide feedback and encouragement during sessions to

keep the caregiver engaged and motivated, as it can be difficult for them to encounter challenging behaviors that they may naturally want to prevent or stop.

Relative to FCT, caregivers are coached in real time, and initially in similar ways as described for the FA. However, our goal shifts very quickly to training the caregiver to implement FCT procedures independently. Unlike the FA, we do want caregivers to conduct FCT in our absence. Thus, we fade our coaching overtime as the caregivers begin to demonstrate independent accuracy with the procedures.

Our initial studies simply provided examples of FA and FCT conducted via telehealth, which served to demonstrate the viability of using telehealth for these procedures. Lindgren et al. (2016) then compared the outcomes of FA plus FCT across service delivery models (in-vivo in-home, clinic-to-clinic telehealth, clinic-to-home telehealth) to determine if telehealth was as effective as the in-vivo service delivery models that we had historically used. Results showed that clinical outcomes (i.e., reductions in problem behavior, improvements in adaptive behavior, parent acceptability) were similar across the three different models of service delivery. That is, there were no statistically or clinically significant differences in these behavioral outcomes across the three service delivery models. Statistically significant differences occurred only for the costs of service delivery, wherein the telehealth models resulted in significantly lower costs than the in-vivo in-home model.

The results summarized in Lindgren et al. (2016) were promising, but these findings are very limited because our projects are based on funded grants. We have restricted enrollment to young children with autism, to parents working with their children, and to reducing challenging behavior. We have focused specifically on challenging behavior maintained by social functions, and we have only studied FCT as our treatment. The positive findings certainly support further use of telehealth, but further research on "timing and dose" (p. S173; Lindgren et al., 2016) issues are warranted.

Clinical Implications of FA and FCT via Telehealth

The historically positive results reported across research projects at the University of Iowa and across other research groups consistently show that practitioners can provide FA plus FCT via telehealth for most young children with autism displaying challenging behavior. These data suggest that behavior analysts can shift their clinical services that target challenging behavior to a telehealth modality, as is needed and/or desired. However, when making this shift, behavior analysts should consider a variety of factors, such as the most appropriate service model (e.g., Wacker et al., 2016), technology issues (e.g., Lee et al., 2015; Lerman et al., 2020), and ethical issues (e.g., Pollard et al., 2017; Romani & Schieltz, 2017), many of which have been previously discussed and highlighted most recently by the *Journal of Behavioral Education* in a special issue dedicated to telehealth and *Behavior Analysis in Practice* in a topical collection of COVID-19 emergency publications. In terms of expanding clinical service delivery to telehealth, we direct behavior analysts to follow the models described in a couple of relatively recent studies that provided successful demonstrations of ways to expand service delivery using telehealth, as well as one study that provides caution.

First, Suess et al. (2016) demonstrated how FA plus FCT delivered via telehealth could be incorporated into an existing outpatient clinic. Specifically, a typical 2-hr clinic appointment was segmented across 4 weeks such that the FA was conducted in Week 1 during a 1-hr appointment, and FCT was conducted across Weeks 2 through 4 during 15-min appointments. These brief visits allowed for quicker and more efficient access to treatment, resulting

in waitlist reductions and cancellations of the in-person appointments because these children showed positive reductions in behavior. However, in the absence of significant behavior reduction, the in-person appointments would have continued as scheduled. In the meantime, the families would have had at least one strategy (FCT) to continue implementing during the wait period, and the clinicians would have developed more fine-tuned hypotheses to test during the in-person clinic visit.

Second, Tsami et al. (2019) further expanded the application of FA and FCT delivered via telehealth by conducting all procedures internationally with children with an autism spectrum disorder. One issue that this study addressed was the consultant-client language barrier, which previous telehealth studies had not addressed. Individuals who were born and raised in the countries of the families were recruited as interpreters, if language interpretation was needed (N = 7). Except for one interpreter, none had prior training or experience in behavior analysis. Rather, the behavior consultant provided training specific to the purpose and procedures of FA and FCT prior to the appointments with the families. Results were positive across all participants, whether or not interpreters were required. Specifically, problem behavior decreased, communication responses increased, and parent acceptability remained high. Additionally, the connectivity between the host site in the United States and the remote sites in various countries remained high with most appointments continuing for at least 92% of the scheduled appointment time.

Nonetheless, not all cases have resulted in positive outcomes. Therefore, Schieltz et al. (2018) sought to understand the FCT treatment failures for two young children when those procedures were conducted via telehealth. Results of those retrospective analyses suggested that treatment failure likely occurred for one child because of a change in behavioral function from social to automatic. For the other child, treatment likely failed because of poor treatment fidelity by the parent. Results for both cases highlight the need for close monitoring of collected data because these analyses will inform clinical decisions regarding when and where services provided via telehealth are most appropriate.

The effects of the novel coronavirus have led to a rush in the widespread use of telehealth. Thus, as we move forward with applications of telehealth, we will need to extend our applications well beyond the existing literature. Fortunately, results to date for the use of FA plus FCT have been mostly positive and suggest that more widespread application is reasonable at this moment in time. However, disseminating results of these applications, including negative findings, will be important to guide our future use of telehealth. As we continue to move forward in applying FA and FCT via telehealth, we should do so with the realization that there is much more for us to learn to maximize the clinical potential of this service modality.

Research Implications of FA and FCT via Telehealth

Lindgren et al. (2020) concluded in their discussion that the questions regarding telehealth have to do with the conditions under which it can be best used, and not whether it should be used at all. Thus, apart from the considerations for expanding our clinical services to include telehealth, there are many considerations for future research (Table 3). As mentioned previously, Lindgren et al. (2016) suggested that the use of telehealth be considered in terms of timing and dose (i.e., when and how much it should be used), which may depend on other variables that have not been extensively studied within a telehealth service model.

For example, Barretto et al. (2006) is the only study in our review that conducted an

alone test condition in the FA. Because challenging behavior decreased across sessions, the researchers did not identify an automatic function. Similarly, Schieltz et al. (2018) showed in a retrospective analysis of treatment failure that challenging behavior likely shifted from a social function to an automatic function. However, that study was conducted after the participant was discontinued from the research project. Therefore, to our knowledge, no telehealth studies have successfully demonstrated the assessment or treatment of behavior maintained by automatic reinforcement. This has likely occurred because the assessment of automatic functions conducted remotely and in the homes of parents is challenging due to the child needing to be left alone without access to items, which can be especially difficult in home settings such as living rooms. As other authors have shown, the treatment of automatically maintained problem behavior can be very difficult to treat even under highly controlled conditions (Hagopian et al., 2015).

Other variables that have been studied or incorporated on a limited basis within a telehealth model include parent implementation fidelity (Schieltz et al., 2018; Suess et al., 2014), the use of interpreters (Tsami et al., 2019), and cultural adaptations when providing services to families in different countries (Tsami et al., 2019). Except for one case example (see Schieltz et al., 2018), these studies reported reductions in problem behavior. However, these studies did not aim to systematically evaluate the effectiveness of these variables on child behavior. That is, Suess et al. (2014) and Schieltz et al. (2018) simply evaluated what occurred relative to parent implementation fidelity and the effects those results had on challenging behavior. Tsami et al. (2019) simply adapted the manner in which the telehealth services were delivered to increase the likelihood of success given the various language and cultural differences between the behavior consultant and families served.

In addition to these factors, other potentially important variables or outcomes have not been studied or evaluated to our knowledge. These include caregiver stress, caregiver preference for types of services, stimulus generalization for both caregiver and child behavior, and procedures that best promote generalization. All of these variables warrant further study to begin identifying the limits of telehealth; in turn, this knowledge should assist us in prescribing the appropriate timing and dose of telehealth services for each family. For example, initiating services via telehealth for families that struggle with using technology, prefer in-person visits, or cannot reliably follow verbal-only instructions may not be the best first step in clinical practice. A more complete understanding of these variables and how they impact the delivery of services and the outcomes for the child and family is needed to guide future clinical practices.

Finally, if we are going to expand our use of telehealth to provide services for challenging behavior, a critical next step is to systemically evaluate training models. Different approaches have been shown to be effective in increasing providers' and parents' skills via telehealth. For example, some have included only live performance feedback (Machalicek et al., 2010); some have provided initial training through workshops or online modules, followed by coaching and performance feedback via telehealth (Fisher et al., 2014; Frieder et al., 2009; Heitzman-Powell et al., 2014); and others have provided a combination of these activities (Bassingthwaite et al., 2018).

For example, Machalicek et al. (2010) trained classroom teachers to conduct FAs of challenging behavior, wherein the researcher provided performance feedback in real-time via telehealth. This model of training resulted in accurate implementation of FA procedures across all six teachers, which maintained in the absence of performance feedback during 3-week posttraining probes. Similarly, Frieder

et al. (2009) trained a teacher and speech-language pathologist to conduct an FA of challenging behavior in the classroom. Initial training occurred via in-person workshops, followed by in-person coaching on the FA procedures across 2 days and remote coaching for the remaining FA sessions. Assessment fidelity results were 100% across observations.

On the other hand, Heitzman-Powell et al. (2014) trained parents via online modules to implement behavior change strategies, then provided live coaching. After parents completed an online module and met criteria on a knowledge assessment for providing contingent reinforcement, for example, the researcher instructed parents to demonstrate these procedures with their children via videoconferencing. Depending on their accuracy, the researcher provided coaching, which included prompts and feedback, until the parents met the 80% fidelity criterion. Results showed performance improvements across all targeted skills following this training package. Fisher et al. (2014) used a similar model to train behavioral technicians on behavior analytic principles and procedures.

A training model proposed by Bassingthwaite et al. (2018) included a three-step fading plan. First, training included in-person modeling and coaching of behavior analytic skills. Second, the trainer provided coaching via telehealth while the trainer was in the same physical building as the trainees. The purpose of this step was to provide the trainee with independent opportunities to demonstrate the skill but continue to provide in-person modeling and coaching in the event of procedural changes that went beyond the trainee's skill level. Finally, the third step consisted of telehealth coaching, wherein the trainer monitored the trainee's skill performance for maintenance at a distant site.

We are currently considering how to best combine the live coaching models we most often use (e.g., Wacker et al., 2013a, b) with the Extension for Community Health Outcomes model (Arora et al., 2011; Project ECHO, n.d.). Project ECHO is grounded in case-based learning, wherein local providers connect into a live virtual learning environment with other local providers and a team of experts. The goal is to disperse expert knowledge to local providers so clients can receive the care they need where they are located (Project ECHO, n.d.). This goal is achieved through brief didactic instruction on targeted topics and case presentations provided by the local providers. Specific to the case presentations, a local provider presents a case that is obtained through their local practice. Other local providers participating in the ECHO clinics, as well as the expert multidisciplinary panel, ask clarifying questions. The expert panel then provides recommendations for next steps. Through this ongoing telementoring model (typically two 1-hr meetings each month for about six months), local providers develop a learning community with other local providers and begin to apply this specialty knowledge within and across their practices, thereby allowing clients to receive more specialty care where they are located. With this training model, we envision behavior analysts who are interested in expanding their expertise to challenging behavior to (a) implement behavior analytic procedures for challenging behavior under the direct supervision and coaching of an expert via telehealth while also connecting to ECHO clinics (e.g., twice per month) to present cases, and (b) receive ongoing mentoring and additional expert knowledge that is related to challenging behavior.

Summary

Across studies that have used telehealth to address challenging behavior, most results have shown that these services can be effectively provided via telehealth when conducting FA and FCT with young children with developmental disabilities who display socially maintained

Table 3

Selected Research Considerations for Expanding Telehealth Services for Challenging Behavior

Consideration	Question(s)	Conclusion(s) or Suggestion(s)
Automatic reinforcement/alone condition	Can automatic functions be safely evaluated and treated via telehealth?	No studies have provided a successful demonstration of assessment and treatment of automatic functions.
Parent implementation fidelity	When should coaching via telehealth use dense prompting versus teaching the family to conduct procedures independently?	The conditions for improving implementation fidelity warrant further study as only one study has evaluated this specifically.
Interpreters	What should occur if a family needs interpreter services?	Location of the interpreter has appeared irrelevant to the results obtained for either functional assessments or treatments, but too few exemplars are available to be conclusive. Therefore, further study is warranted on the use of interpreters and translation software.
Services across cultures	Can telehealth services be successfully provided across countries and cultures?	Success has been achieved across distinct groups and countries, but consideration of equipment needs, especially connectivity, interpreter services, country political issues, natural disasters, and cultural observations need to be identified and evaluated.
Timing and dose	When should telehealth services be conducted and at what intensity level?	These conditions warrant further study as most studies provided weekly services over a relatively long period of time.
Caregiver stress and preference	What effects does behavioral treatment delivered via telehealth have on caregiver stress and preference for types of services?	No studies have reported these effects, resulting in the need for further study.
Generalization of skills	What are the best ways to ensure generalization of skills when behavioral treatment is conducted via telehealth?	Studies on stimulus generalization associated with both caregiver (e.g., delivering reinforcement) and child (e.g., manding) behaviors are needed.
Limits of telehealth	Which children and families will benefit from telehealth services?	Most studies, to date, have enrolled young children with autism.
	What types of assessments and treatments can be delivered via telehealth?	We have struggled with how to effectively assess automatic functions. Studies employing preference assessments are needed.

challenging behavior. When compared to in-vivo, in-home services, telehealth services have resulted in similar reductions of challenging behavior while maintaining high levels of parent implementation fidelity and parent acceptability, with significantly lower costs (Lindgren et al., 2016). Thus, we are in a position to greatly expand and increase access to behavioral services via telehealth. However, we must also continue to tread with caution as the limits of telehealth are unknown. For example, children with challenging behavior that serves an automatic function have not been the focus of any telehealth research, nor have older individuals who engage in severe aggression that may harm others. Additionally, the expertise of providers in delivering services via telehealth is likely limited, resulting in the need for additional training and consultation. Finally, as we navigate this public health crisis, we anticipate that many behavior analysts are offering telehealth services for the first time. Therefore, we implore those poised to engage in telehealth to do what behavior analysts always do: "do

good [work and], take data," (p. 267; Risley, 2001)! And then disseminate those data because that is how we are going to advance our understanding and practice of telehealth within our field.

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